Original article

# Association between oral health and quality of life among primary school students in Hue city, Vietnam

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**Abstract**

**Background:** Oral health problems, especially dental caries, remain highly prevalent among children and reduce quality of life.

**Objectives:** This study assessed oral health status and oral health-related quality of life (OHRQoL) among Vietnamese primary school children and examined its associations with clinical factors.

**Materials and method:** A cross-sectional study was conducted among 343 children aged 8-11 years at a Hue City elementary school. Participants completed the Child Perceptions Questionnaire (CPQ) to evaluate OHRQoL across four domains: oral symptoms, functional limitations, emotional well-being, and social well-being. Clinical examinations measured dental caries (DT+dt), missing teeth (MT+mt), and oral hygiene (OHI-S). Data were analyzed using descriptive statistics, t-tests, ANOVA, and multivariate linear regression.

**Results:** The sample comprised 180 females (52.5%) and 163 males (47.5%). Mean DT+dt was 6.5 ± 3.9, MT+mt 0.2 ± 0.6, and OHI-S 1.5 ± 0.7. The total CPQ score was 13.6 ± 11.9, with no significant gender differences but increasing scores with age (significant in emotional well-being, $p = 0.042$). Regression analysis showed DT+dt ($\beta = 0.50$, $p < 0.01$), MT+mt ($\beta = 2.54$, $p < 0.05$), and OHI-S ($\beta = 2.75$, $p < 0.01$) as significantly associated with total CPQ scores, with domain-specific effects strongest in emotional and social well-being.

**Conclusion:** Clinical oral health factors are strongly associated with OHRQoL among Vietnamese primary school children, particularly a high burden of untreated dental caries and poor oral hygiene.

***Keywords:*** *quality of life; dental caries; oral hygiene; children; child perception questionnaire.*

## 1. INTRODUCTION

Oral health is a fundamental component of overall health and well-being, particularly in children, where it plays a crucial role in physical, emotional, and social development [1]. Dental caries remains one of the most prevalent chronic diseases among children worldwide, affecting nearly half of all school-aged children and representing a significant public health concern [2]. Oral hygiene status is a critical determinant of both caries and periodontal health. Research indicates that a majority of school children have only fair oral hygiene, with mean Simplified Oral Hygiene Index (OHI-S) scores typically ranging from 1.1 to 2.5, and only a minority achieving good oral hygiene[3, 4].

These oral health challenges can have significant consequences for children, including pain, infection, impaired chewing and nutrition, speech difficulties, and negative impacts on self-esteem and social interactions, ultimately reducing quality of life [5]. In recent years, the concept of oral health-related quality of life (OHRQoL) has gained increasing attention, reflecting the broader impact of oral health on daily activities, psychological status, and social participation [6]. The Child Perceptions Questionnaire (CPQ8-10) is a widely used, validated instrument for assessing OHRQoL in children, capturing the impact of oral health on oral symptoms, functional limitations, emotional well-being, and social well-being [7].

Despite advances in dental care, the burden of oral problems remains substantial in many regions, including Vietnam [8]. However, to the best of our knowledge, there is no study has examinated the association between common oral health problems and the oral health-related quality of life among children aged of primary school. Therefore, this study aims to assess the oral health status-including caries, gingivitis, periodontal health, and oral hygiene-and oral health-related quality of life among primary school children in Hue City, Vietnam, and to examine the associations between clinical oral health indicators and OHRQoL using the $CPQ_{8-10}$ instrument.

## 2. MATERIALS AND METHODS

This cross-sectional study was conducted at a Hue city elementary school in April 2025. The study population included all children at grade 2 to 5 enrolled at the selected school who could write,

read, and speak Vietnamese fluently. Children with underlying serious medical conditions, those taking long-term medication, or whose parents did not give consent were excluded from participation. Sample size was determined by feasibility within the school census approach (all eligible/consenting children). Of 515 eligible schoolchildren identified from school records, 343 participated, yielding a participation rate of 66.6%. Post-hoc power analysis was conducted for the primary multivariable linear regression model predicting total CPQ score using Stata 14.1 (StataCorp, College Station, TX). The current sample (n = 343) provides > 80% power to detect standardized effect sizes ≥ 0.31 at α=0.05 (two-tailed).

Data collection involved a structured questionnaire and a clinical oral examination. The questionnaire, administered in the classroom, included the Vietnamese version of the Child Perceptions Questionnaire (CPQ8-10) by Jokovic to assess oral health-related quality of life, as well as questions regarding age and gender [9]. The Vietnamese version of the CPQ8-10 (CPQ8-10VN) is a validated 25-item short-form instrument comprising four domains: oral symptoms (6 items), functional limitations (6 items), emotional well-being (6 items), and social well-being (7 items). The CPQ8-10VN demonstrates robust psychometric properties: high internal consistency (Cronbach's α ≥ 0.87 across domains and total), test-retest reliability (ICC ≥ 0.82), construct validity (significant correlations with global ratings of oral health and well-being), and discriminant validity (higher scores in children with caries/calculus vs. healthy peers). Following completion of the questionnaire, a single examiner, trained according to the World Health Organization's Oral Health Surveys criteria, conducted clinical examinations during daylight hours at the school [10]. The clinical assessment focused on dental caries status and oral hygiene, using the Decayed, Missing, and Filled Teeth Index (DMFT for permanent teeth, dmft for primary teeth) to determine caries status, and the Simplified Oral Hygiene Index (OHI-S) by Greene and Vermillion to evaluate oral hygiene [10, 11]. Intra-examiner reliability was assessed through a calibration sub-study. The examiner repeated clinical examinations on 10% of participants (n = 35, randomly selected) one weeks apart under identical conditions. Cohen's κ for caries detection (DT+dt) was 0.82 (95% CI: 0.71 - 0.93), indicating substantial agreement. Intraclass correlation coefficient (ICC) for OHI-S was 0.88 (95% CI: 0.79 - 0.94), indicating excellent reliability.

The main variables measured included age, gender, number of decayed teeth (DT+dt), missing teeth (MT+mt), OHI-S scores, and CPQ8-10 total and domain scores (oral symptoms, functional limitations, emotional well-being, and social well-being). The study was conducted in accordance with ethical standards, with informed written consent obtained from parents or guardians and assent from the children.

For statistical analysis, we use independent t-tests to compare CPQ scores between genders, one-way ANOVA to compare CPQ scores across age groups. A series of multivariate linear regression models were employed to examine factors independently associated with total and domain-specific CPQ scores. The independent variables included gender, age, and each of clinical parameters, such as dental caries (DT+dt), missing teeth (MT+mt), and OHI-S score. Socioeconomic variables (parents' education, occupation) were initially considered but were excluded from the multivariate analysis due to the high rate of missing and inaccurate data self-reported by the young participants. Given the potential deviations from normality in the dependent variable, we applied bootstrapping with 1,000 replications to estimate the bias-corrected and accelerated (BCa) 95% confidence intervals and p-values for the regression coefficients. This method does not rely on the assumption of normality. Statistical significance was set at $p < 0.05$. All analyses were performed using StataMP version 14.1 (StataCorp).

**Ethical considerations**

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments. The study was approved by the Bioethics Committee of Hue University of Medicine and Pharmacy (approval number: H2024/567).

## 3. RESULTS

The research encompassed a total of 343 subjects, characterized by a mean age of 9.7 ± 1.1 years, with a gender distribution that approached a ratio of 1:1 for boys and girls.

**Table 1.** Socio-demographic and Oral Health Characteristics of Study Sample

| Variables | | Total (N=343) |
|---|---|---|
| Gender | n (%) | |
| Girls | | 180 (52.5%) |
| Boys | | 163 (47.5%) |
| Age | n (%) | |
| 8 | | 60 (17.5%) |
| 9 | | 95 (27.7%) |
| 10 | | 79 (23.0%) |
| 11 | | 109 (31.8%) |
| Dental caries (DT+dt) | mean ± SD | 6.5 ± 3.9 |
| Missing teeth (MT+mt) | mean ± SD | 0.2 ± 0.6 |
| OHI-S | mean ± SD | 1.5 ± 0.7 |

The age distribution showed that the majority of participants were 11 years old (109 participants, 31.8%) and 9 years old (95 participants, 27.7%), followed by 10-year-olds (79 participants, 23.0%) and 8-year-olds (60 participants, 17.5%).

Regarding oral health status, participants had a mean dental caries score (DT+dt) of 6.5 ± 3.9. Missing teeth (MT+mt) were minimal with a mean of 0.2±0.6. The Oral Hygiene Index-Simplified (OHI-S) showed a mean score of 1.5 ± 0.7, indicating fair oral hygiene among the study participants.

**Table 2.** Mean CPQ score according to gender and age

| CPQ score (mean ± SD) | Gender | | | Age mean±SD | | | | |
|---|---|---|---|---|---|---|---|---|
| | Boys | Girls | p-value[a] | 8 | 9 | 10 | 11 | p-value[b] |
| Oral symptoms | 3.6 ± 3.1 | 4.2 ± 3.4 | 0.063 | 3.1 ± 2.8 | 3.7 ± 3.3 | 4.1 ± 2.9 | 4.3 ± 3.6 | 0.119 |
| Functional limitations | 2.8 ± 3.0 | 2.6 ± 2.9 | 0.554 | 2.5 ± 2.5 | 3.0 ± 3.0 | 2.5 ± 3.0 | 2.7 ± 3.0 | 0.729 |
| Emotional well-being | 4.0 ± 3.9 | 3.2 ± 3.8 | 0.055 | **2.8 ± 3.3** | **3.0 ± 3.1** | **4.0 ± 3.7** | **4.2 ± 4.6** | **0.042** |
| Social well-being | 3.3 ± 4.1 | 3.5 ± 4.9 | 0.783 | 2.7 ± 3.9 | 3.5 ± 4.3 | 3.2 ± 3.7 | 3.9 ± 5.5 | 0.449 |
| Total CPQ | 13.7 ± 11.3 | 13.5 ± 12.5 | 0.878 | 11.1 ± 9.4 | 13.2 ± 10.9 | 13.9 ± 11.2 | 15.1 ± 14.2 | 0.201 |

[a] Independent sample t-test, [b] ANOVA one way test

Table 2 shows the Child Perceptions Questionnaire (CPQ) scores across gender and age groups. Girls consistently reported higher scores than boys across most domains, with oral symptoms showing the largest difference (4.2 ± 3.4 vs 3.6 ± 3.1), though this was not statistically significant (p = 0.063). Notably, boys reported higher emotional well-being scores (4.0 ± 3.9) compared to girls (3.2 ± 3.8), approaching statistical significance (p = 0.055).

Age-related analysis showed a clear trend of increasing CPQ scores with advancing age. The total CPQ score increased from 11.1 ± 9.4 at age 8 to 15.1 ± 14.2 at age 11. Emotional well-being showed the only statistically significant age-related difference (p = 0.042), with scores progressively increasing from 2.8 ± 3.3 at age 8 to 4.2 ± 4.6 at age 11.

**Table 3.** Multivariate linear regression analysis for CPQ total score and four domains score according to the social characteristic and oral clinical conditions.

| Independent variables | Total CPQ | | Oral symptoms | | Functional limitation | | Emotional well-being | | Social well-being | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Coef. B | Coef. β | Coef. B | Coef. β | Coef. B | Coef. β | Coef. B | Coef. β | Coef. B | Coef. β |
| Gender | | | | | | | | | | |
| Boys | -0.49 | -0.68 | -0.76 | -0.22 | 0.05 | 0.02 | 0.61 | 0.16 | -0.39 | -0.10 |
| Girls | Ref. | | Ref. | | Ref. | | Ref. | | Ref. | |
| Age | | | | | | | | | | |
| 8 | Ref. | | Ref. | | Ref. | | Ref. | | Ref. | |
| 9 | 3.74 | 5.04 | 0.97 | 0.27 | 0.75 | 0.026 | 0.65 | 0.17 | 1.37 | 0.29 |
| 10 | 4.92* | 6.97* | 1.36* | 0.42* | 0.53 | 0.18 | 1.81** | 0.47** | 1.23 | 0.28 |
| 11 | 6.91** | 9.81** | 1.56** | 0.49** | 0.89 | 0.30 | 2.32*** | 0.60*** | 2.14** | 0.49** |
| DTdt | 0.50** | 2.82** | 0.03 | 0.04 | 0.12* | 0.15* | 0.18** | 0.18** | 0.18* | 0.16** |
| MTmt | 2.54 | 2.05 | 0.46 | 0.07 | 0.75** | 0.15** | 0.56 | 0.08 | 0.77 | 0.10 |
| OHI-S | 2.75** | 2.69** | 0.38 | 0.08 | 0.25 | 0.06 | 1.04*** | 0.19*** | 1.08** | 0.16** |

*$p < 0.05$, **p < 0.01, ***p < 0.001 B: unstandardized coefficient; β: standardized coefficient

Table 3 presents the results of the multivariate linear regression analysis. After adjusting for potential confounders and applying robust standard errors, age and clinical oral health indicators were found to be significantly associated with oral health-related quality of life. Notably, age showed a strong association, with 10- and 11-year-olds exhibiting significantly higher total CPQ scores than 8-year-olds (standardized coefficients: 6.97 and 9.81, p = 0.011 and p = 0.003, respectively). The 11-year age group demonstrated strong associations across various domains, except for functional limitations. Among clinical indicators, dental caries (DTdt) and poor oral hygiene (OHI-S) showed consistent positive associations, except for oral symptoms. Missing teeth (MTmt) were significantly associated only functional limitations (standardized coefficient: 0.15, p < 0.01).

## 4. DISCUSSION

This study assessed the oral health-related quality of life in children between the ages of 8 to 11 years and explored its association with clinical oral health conditions. The main finding indicated that children in this population exhibited a considerable burden of dental caries, and factors such as age, history of dental caries, the presence of missing teeth, and inadequate oral hygiene were significantly associated with poorer oral health-related quality of life.

Our study reveal a high number of decayed teeth which is consistent with previous studies conducted in developing countries [12]. Pakkhesal et al. found a mean dmft index of 3.94 ± 4.17 and Chen et al. reported mean of untreated caries (dt) of 4.85 ± 4.93 in preschool children, while Eid et al. reported DMFT scores of 2.97 ± 1.29 in 11 - 14 year olds [12, 13]. The total CPQ score of 13.6 ± 11.9 demonstrates that children's daily life are affected by the oral health conditions. The oral symptoms domain showed the highest scores, which is expected given that dental pain and discomfort are often the most immediately noticeable consequences of poor oral health [14].

A particularly noteworthy finding is the progressive increase in CPQ scores with advancing age, with 11-year-olds showing significantly higher scores compared to younger children. The age-related coefficients demonstrate a clear dose-response relationship, with progressive increases in quality of life scores as children age. This age-related pattern aligns with research by Pinheiro et al., who found that children aged 9 and 10 years were more likely to have negative quality of life impact compared to children aged 8 [15]. Our result is also consistent with findings from Jokovic et al., who reported that older children within the 8-10 age range had higher CPQ scores, though their study showed smaller effect sizes [9]. The increasing CPQ scores with age in this study may reflect greater self-awareness and social consciousness among

older children, making them more sensitive to the aesthetic and social implications of dental problems [14]. The significant age effect in emotional well-being ($p = 0.042$) suggests that older children experience greater psychological distress related to their oral health status. This finding is consistent with developmental psychology literature indicating that self-consciousness and peer comparison become more prominent during late childhood and early adolescence [9, 14].

The lack of statistical significance for all gender coefficients suggests that when controlling for clinical oral health factors and age, gender differences in quality of life scores become negligible. This finding contrasts with study of Jokovic et al., which reported that girls had significantly higher mean CPQ scores (20.6) compared to boys (17.0) in their validation study [9]. However, our findings align more closely with research by Barbosa et al., who found that gender effects diminished when controlling for clinical variables in multivariate models [16].

**Clinical Factors Associated with Quality of Life Score**

The multivariate regression analysis revealed that clinical oral health indicators were strongly associated with quality of life score. The significant association between dental caries and total CPQ scores (coefficient: 0.50, $p < 0.01$) confirms findings from numerous previous studies establishing the relationship between caries experience and reduced quality of life in children [17, 18]. The effect size in our study is comparable to findings from Abanto et al., who reported similar coefficients for caries impact on ECOHIS scores in preschool children [5]. However, it is somewhat lower than the effect reported by Kramer et al., who found stronger associations between caries experience and quality of life in their pediatric population [19]. The domain-specific analysis reveals that the association between caries and quality of life score is not evenly distributed across quality of life aspects. Functional limitations show a significant association (coefficient: 0.12, $p < 0.05$), which aligns with findings from Filstrup et al., who demonstrated that dental pain and discomfort significantly interfere with daily activities such as eating, speaking, or sleeping [20]. The emotional well-being coefficient of 0.18 ($p < 0.01$) is consistent with research by Sheiham, who found that dental caries contributes substantially to psychological distress in children [18]. Interestingly, the oral symptoms domain shows a non-significant coefficient (0.03), which may seem counterintuitive given that dental caries typically causes pain and discomfort. This finding contrasts with studies by Pakkhesal et al., who found strong associations between caries experience and symptom reporting [17]. Our finding might reflect the chronic nature of caries in this population, where children may have adapted to persistent low-level discomfort, similar to patterns observed by Baghdadi et al. in populations with high caries prevalence [21].

Although the coefficient for missing teeth was 2.54 ($p < 0.05$) in the regression model, missing teeth were not significantly associated with the CPQ total score or most sub-domains. The observed effect was confined to functional aspects of OHRQoL (coefficient: 0.75, $p < 0.01$), consistent with evidence that tooth loss directly compromises chewing efficiency, speech clarity, and overall oral function [22]. The absence of significant associations with other domains may reflect the relatively low prevalence of missing teeth in this young population (mean: 0.2 ± 0.6), similar to limitations noted by Barbosa et al. in their pediatric quality of life research [23].

The oral hygiene showed a strong association in the model, indicating that poor oral hygiene has substantial quality of life consequences beyond its clinical implications. This finding is strongly supported by research from Patanapu et al., who found significant positive correlations between OHI-S scores and total CPQ scores across both genders [24]. Similarly, Abreu et al. demonstrated that children with regular/poor oral hygiene conditions had significantly higher ECOHIS scores (6.36 ± 6.35) compared to those with good oral hygiene (4.43 ± 5.35) [25]. The emotional well-being domain shows the strongest association with oral hygiene status (coefficient: 1.04, $p < 0.001$), which is consistent with findings from Asiri et al., who suggested that poor oral hygiene causes significant psychological distress due to embarrassment about visible plaque, bad breath, or gingival bleeding [26]. This effect size exceeds that reported in most previous studies, suggesting that the psychological burden associated with poor oral hygiene may be particularly pronounced in our population. The social well-being coefficient of 1.08 ($p < 0.01$) aligns with research by Marshman et al., who found that poor oral hygiene substantially affects children's social interactions, potentially leading to avoidance behaviors and reduced participation in social activities [27]. This finding is also supported by qualitative research from Rodd et al., who documented the social stigma associated with poor oral hygiene and its consequences for children's social development

[28]. Overall, clinical parameters were associated with the total CPQ score, whereas domain-specific analyses indicated that dental caries were strongly associated with functional limitations and emotional well-being, missing teeth with functional limitations, and poor oral hygiene with both social and emotional well-being.

**Strengths and limitations**

This study has several strengths, including a substantial sample size of 343 participants, which provides adequate statistical power and generalizability. The balanced gender distribution and age range improve result representativeness. In addition, validated instruments like the CPQ and standardized clinical indices ensure reliable measurements and facilitate international comparisons. The CPQ shows strong construct validity and reliability [29, 30]. The inclusion of multiple CPQ domains enables identification of specific areas most affected by oral health problems, consistent with the multidimensional nature of oral health-related quality of life [14]. Last but not least, a multivariate analytical approach allows for the examination of multiple associated factors while controlling for confounders.

Several limitations should be acknowledged when interpreting these findings. The cross-sectional design precludes establishment of causal relationships between oral health status and quality of life impact. Longitudinal studies would be needed to better understand the temporal dynamics of these associations. The study's population is limited to a specific geographic setting, which may affect the generalizability of the findings. The lack of socioeconomic status indicators is a significant limitation, as these factors are known to influence oral health and quality of life. Previous research shows that children from families with lower maternal education and socioeconomic status have higher untreated caries scores.[12, 13] Additionally, reliance on self-reported quality of life measures may introduce response bias, especially among younger children. Furthermore, the study does not control for confounding factors like access to dental care or dietary habits.

## 5. CONCLUSION

This study highlights the multidimensional nature of OHRQoL and emphasize that clinical factors extend beyond physical symptoms to affect psychosocial well-being. The results confirm that untreated oral conditions in resource-limited settings contribute to functional limitations, psychological distress, and social withdrawal. Future longitudinal studies should include socioeconomic factors and broader oral health indicators like gingivitis to clarify causal relationships and long-term outcomes.

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